
Laptops in Space: Everybody Wants One

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Presentation Overview

- How did Laptops in Space get started?
- How are Laptops in Space used?
- What are some of the challenges of managing Laptops in Space?
- Looking Forward
- Closing and Q&A

How did Laptops in Space get started? Or better...Why is this man so happy?



- Commander John Young on STS-9, December 1983
- First flight of SPOC - the Shuttle Portable Onboard Computer
- GRiD Compass “Portable” Computer

How did Laptops in Space get started?

- **The GRiD Compass – A Complete Portable System**
- **Generally considered the first laptop – ten pounds**
- **8086 system with 8087 co-processor, 512K RAM, and 384K of bubble memory**
- **“Clamshell” 4”x4” Electroluminescent (EL) Display**
- **Cooling fan added to pull air through the case**
- **GRiD-OS Operating system and GRiD development tools**
- **The initial software was developed at JSC in MOD and included:**
 - **WorldMap display showing three groundtracks, day/night shading**
 - **MET Clock**
 - **AOS/LOS clocks for ground and TDRSS stations**
 - **Earth Observation clock and suggested F-Stop setting for camera**

How did Laptops in Space get started?

GRID

IT'S MORE THAN JUST A
HIGH PERFORMANCE
PORTABLE COMPUTER.

GRID

**THE GRID COMPASS.
THIS IS WHAT HIGH PERFORMANCE
REALLY MEANS.**

GRID computers have up to 1.4 million characters of internal memory capacity—or over 500 typed pages!

GRID computers can do many calculations as fast as minicomputers. Only GRID offers two central processors: a 16-bit Intel 8086 that's compatible with IBM-PC software, and a special high speed 8087 numeric and graphics processor.

GRID's high contrast light-emitting EL screen can be viewed from any angle and under any lighting conditions.

With our new large 8 1/2" EL screen, you can display 25 lines and up to 128 characters across, all at once.

GRID computers have the unique capacity to hold up to 512K of user installable ROM cartridges with standard or customized software.

GRID computers weigh just 10 pounds and fit nicely into a briefcase. Yet they're *more powerful* than most desktop computers.

GRID is the most rugged portable computer on the market. Its solid state electronics and magnesium case can withstand impacts of up to 160 G's!

GRID uses reliable bubble memory that acts like a built-in electronic disk drive.

With GRID's built-in high speed 1200 baud modem, you can send data over ordinary phone lines. And you can do it *four times faster* than with other portables!

GRID Server connects both GRID computers and IBM-PC's in a local and remote area network. Up to 58 users can communicate simultaneously, from any location.

GRID supports MS-DOS and over 100 of the most popular IBM-PC programs.

There are over 17 GRID software programs to choose from. They all work together and are extremely easy to use.

Specifications

PORTABLE COMPUTER FAMILY:
9 models available
Easy to read light emitting EL screen
Up to 512K RAM
384K of non-volatile bubble memory
Up to 512K of user-installable ROM cartridges
High speed 300/1200 baud modem
Rugged magnesium case
Weighs 10 pounds

SOFTWARE:
17 Easy to learn Integrated Software Packages
Extensive communications software, including DEC VT100, IBM 3101 and TTY terminal emulators
Complete program development environment with 5 languages

MS-DOS operating system and over 100 popular IBM-PC programs
Electronic software distribution

PERIPHERALS:
Portable IBM-PC format floppy disk drive
10MB Hard Disk System with floppy disk drive
GRIDCentral high capacity data storage via phone line
Plotters, dot matrix, inkjet, and letter quality printers

GRID SERVER:
Supports up to 58 GRID computers and IBM-PC's
Share files and peripherals in or out of the office
Access via phone or twisted pair cable
10 and 40 megabyte disk drives

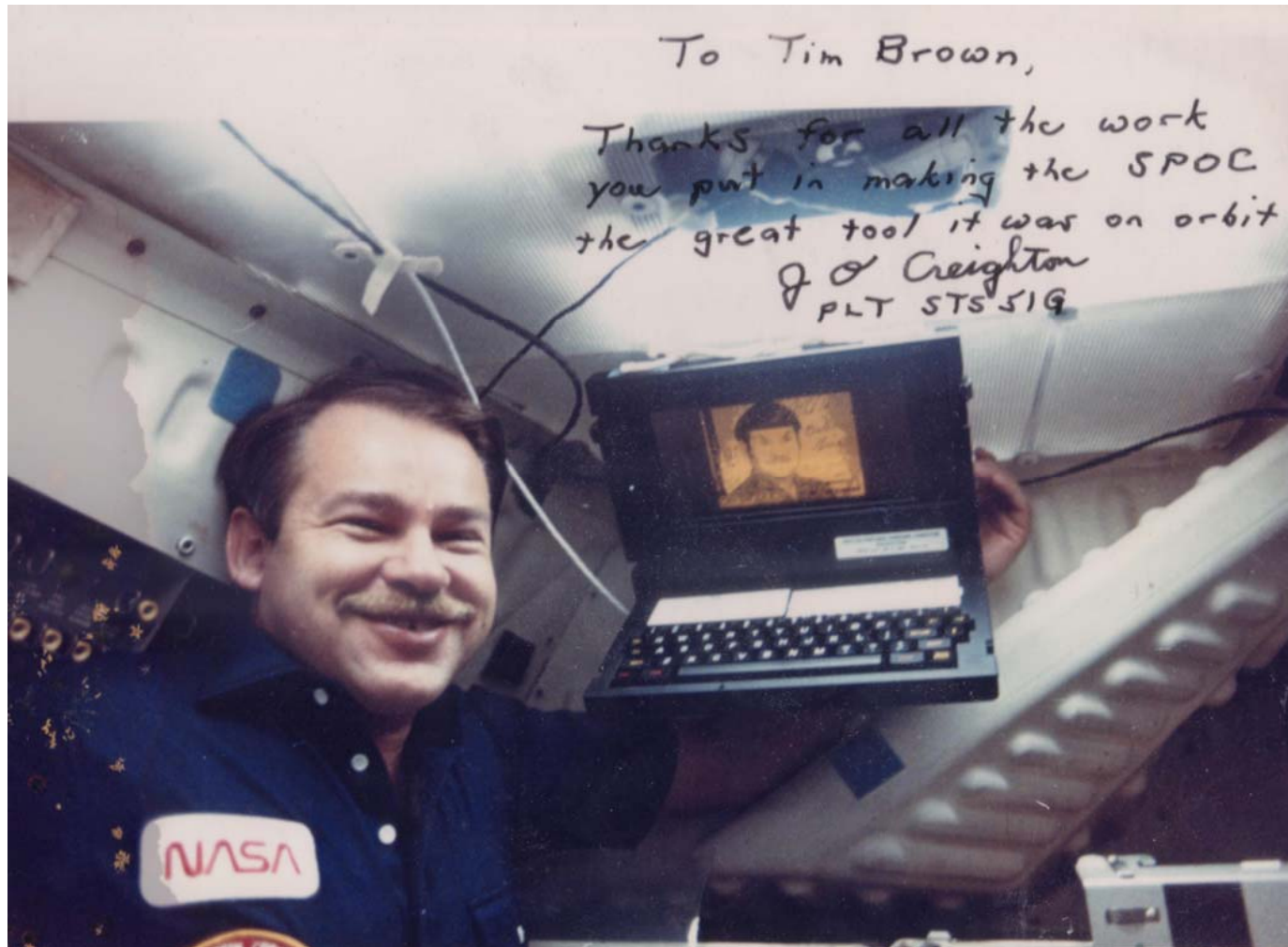
TRAINING, SERVICE, AND SUPPORT:
Management Tools Software Workshops
Program Development Training
On-Site Applications Consulting
Computers available for loan during repairs
10 hour a day telephone assistance

For more information call 800-222-GRID
GRID Systems Corporation
2535 Garcia Avenue
Mountain View, CA 94043
(415) 961-4800
Sales Offices: New York, Chicago, Los Angeles, Washington D.C., San Francisco, Dallas, Houston, Atlanta, Boston, Philadelphia, Paris, London, Ontario, Distributors worldwide.

GRID

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How did Laptops in Space get started?



Beyond SPOC...

- **Payload and General Support Computer - PGSC**
 - The applications quickly surpassed the capabilities of the SPOC, and a new program, the Payload and General Support Computer (PGSC) project, was created to provide a single crew interface for mission software and payload control.
 - The first PGSC was a modified GRiD model 1530. It was a 80C386 32 bit 12.5Mhz with a 80387 math coprocessor, 4Mb of Ram (expandable to 8Mb), one 3.5" floppy drive, and a 20Mb fixed drive (later upgraded to 40Mb).
 - The PGSC was first flown on STS-29 in March 1989.
 - Starting with STS-63 the PGSC was upgraded to an IBM 755c ThinkPad
 - Intel 486DX4, 75Mhz processor, 12Mb of RAM expandable to 36Mb, removable 540Mb hard drive, and a 10.4" active matrix screen.
 - An expansion chassis was also developed to allow for PC cards to be added to the system

Beyond SPOC...

- **Laptops Today**
 - **Payload and General Support Computer – Shuttle**
 - **Portable Computer System – ISS**
 - **Station Support Computer – ISS**
 - **Personal Digital Assistant – ISS**
 - **Payload-specific laptops – Shuttle and ISS**
 - **Medical Equipment Computer - ISS**
 - **Almost all are IBM A31P ThinkPads**

Beyond SPOC...



Beyond SPOC...

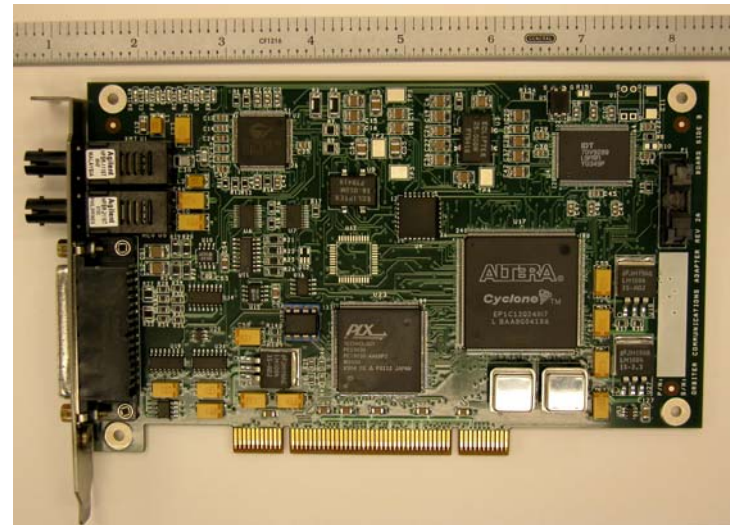
- Two major leaps forward in 1993
 - Telemetry from the Pulse Code Modulation Master Unit (PCMMU)
 - Two way space-to-ground communication

Beyond SPOC...

Orbiter Communications Adapter

Background

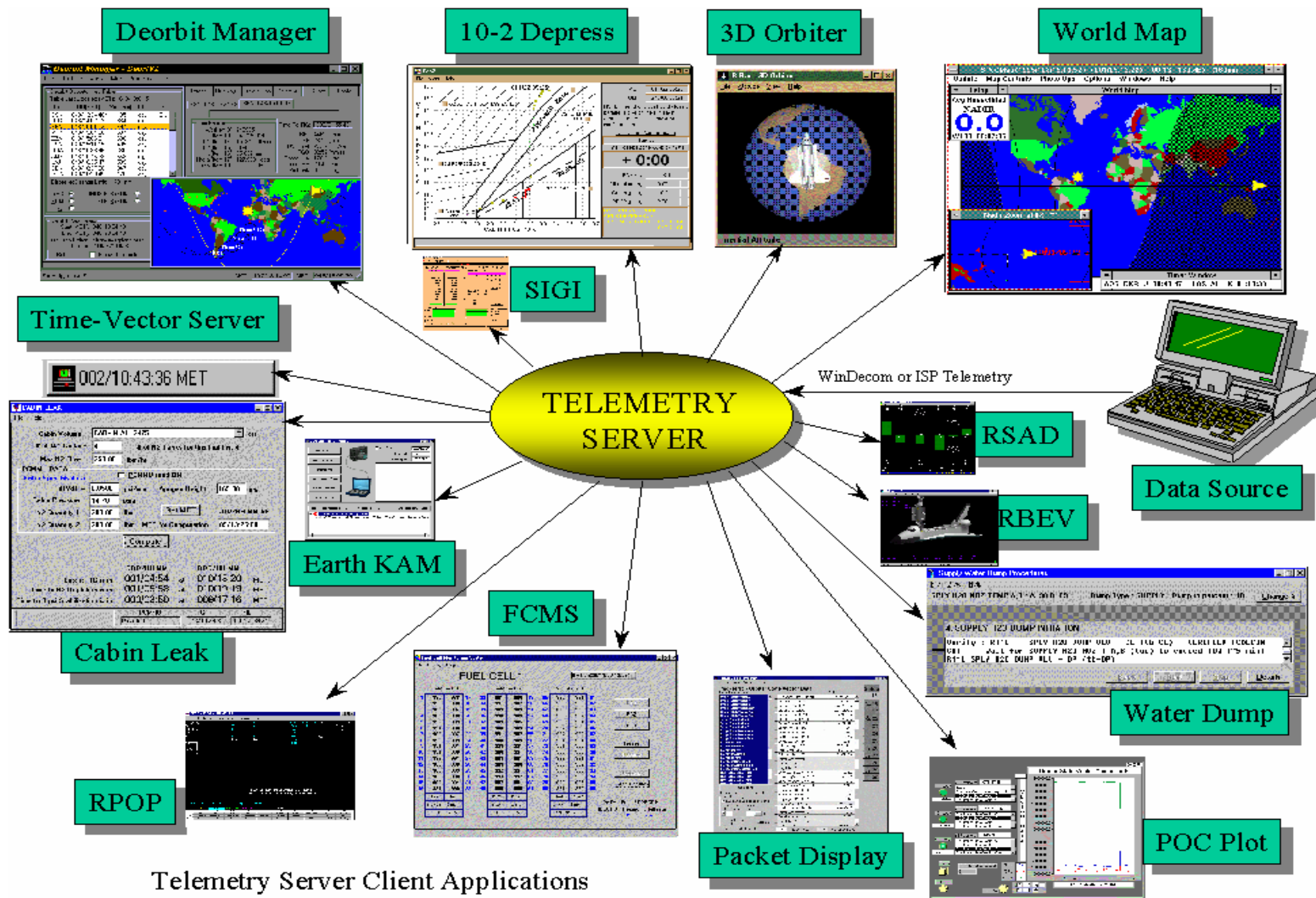
- The Orbiter Communications Adapter (OCA) card provides two way space-to-ground communication between computers via the TDRSS Ku-band link.
 - OCA translates between COTS-based computers/networks and proprietary NASA communications systems on Shuttle and ISS.
 - OCA cards are installed into Microsoft Windows-based computers, in conjunction with an EV-developed Windows device driver.
 - When coupled with Windows server software, the OCA can virtually connect space and ground LANs.
 - First flight in 1993 (KCA), with Revision 1 currently in use on ISS.
 - Revision 2A card slated for use with SVG and A31p-based OCA Router.



Usage

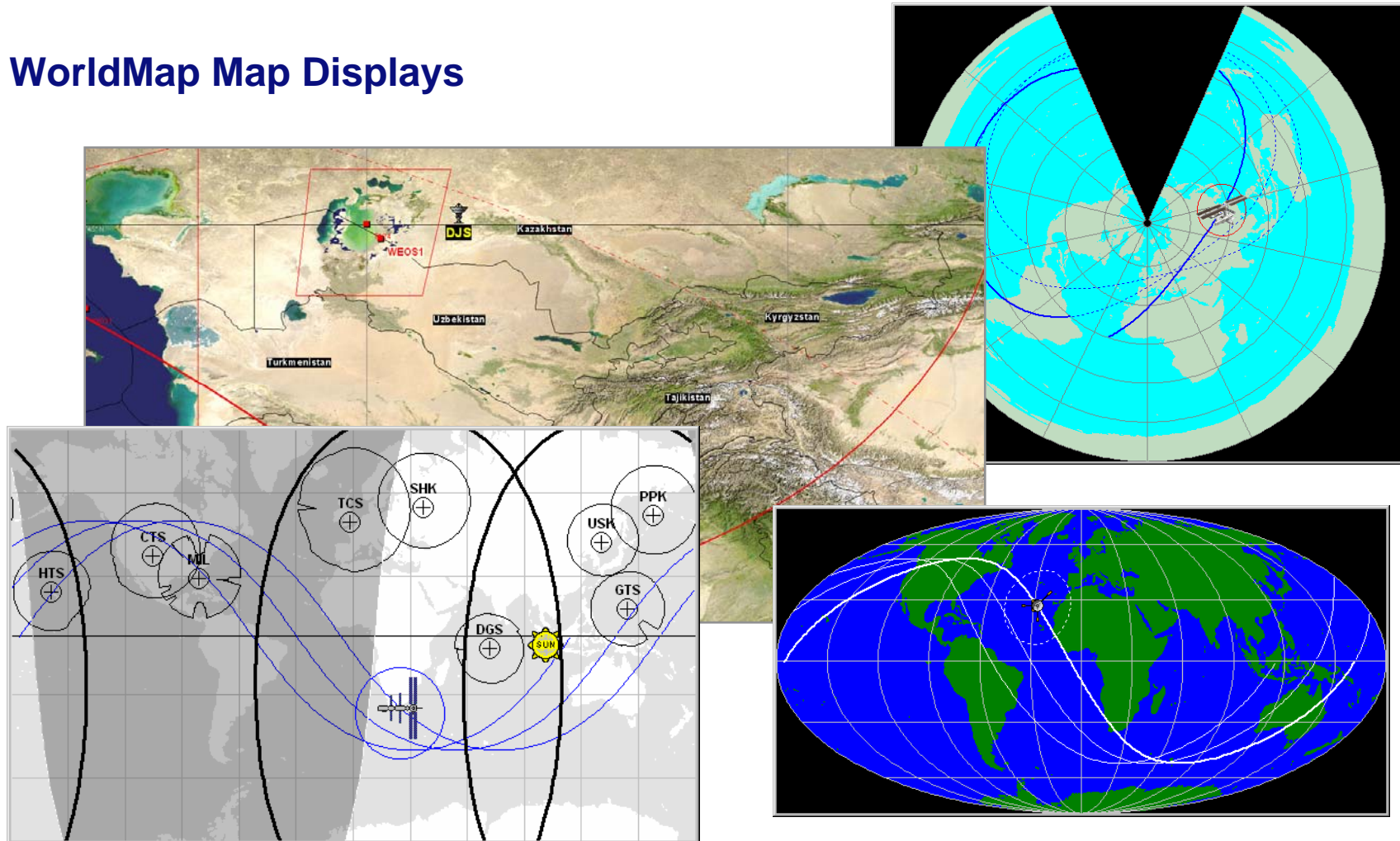
- File transfers (including OBSS data)
- IP phone
- Net Meeting video teleconferencing
- Electronic white board
- SVG video downlink
- Many other COTS IP-based applications...

How are Laptops in Space Used?



How are Laptops in Space Used?

WorldMap Map Displays



How are Laptops in Space Used?

WorldMap Pass Predictions

Observer: Houston, TX (C0179) Position= 29.7° -95.4° Altitude= 0.00 nm
 Target: ISS (25544) Position= 26.6° -27.7° Altitude= 191.8 nm
 Obs to Trg: Azimuth= 75.1°ENE Declination= 26.7° Range= 3486.5 nm

Date(GMT)	Time of AOS	Time of MEL	Time of LOS
2005/067	09:36:34	09:38:10	09:39:46
2005/068	00:25:34	00:27:25	00:29:16

Lake Chad Pass Predictions

Observer: ISS (25544) Position= 44.3°S 153.3°W Altitude= 199.7 nm
 Target: Lake Chad (T015) Position= 13.0°N 14.0°E Altitude= 0.00 nm
 Obs to Trg: Azimuth= 156.9°SE Declination= 74.0° Range= 6790.1 nm

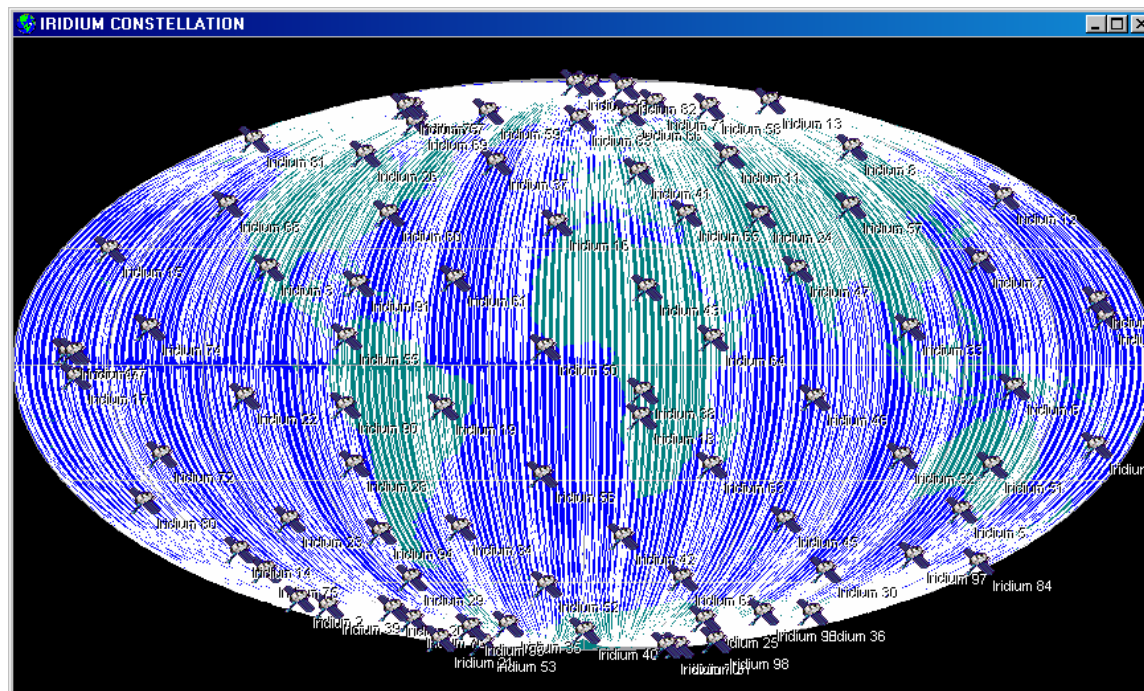
Date(GMT)	Time of AOS	Time of MEL	Time of LOS	Pass Duration	Az. AOS	Az. MEL	Az. LOS	Peak Angle	Vis AML	AOS Orbit#
2005/074	00:28:51	00:32:09	00:35:27	00:06:35	132°	051°	333°	58.8°	NNN	36087
2005/074	13:35:48	13:39:15	13:42:36	00:06:47	041°	131°	214°	67.8°	DDD	36096
2005/074	23:21:51	23:24:39	23:27:39	00:05:47	170°	230°	294°	29.4°	NNN	36102
2005/075	00:58:51	00:59:39	01:00:54	00:02:02	072°	058°	037°	20.4°	NNN	36103
2005/075	12:28:57	12:31:48	12:34:42	00:05:44	002°	308°	251°	27.5°	DDD	36111
2005/075	14:05:18	14:07:09	14:08:57	00:03:38	095°	128°	162°	21.4°	DDD	36112
2005/075	23:49:21	23:52:33	23:55:45	00:06:23	125°	052°	341°	42.7°	NNN	36118
2005/076	12:56:15	12:59:36	13:02:54	00:06:38	049°	126°	207°	48.7°	DDD	36127

2005/073/15:42:10 Closest Approach: 2005/074/13:39:15 Angle: 67.8° Range: 210.4 nm

Date(GMT)	Time of AOS	Time of MEL	Time of LOS
2005/076	16:37:08	16:37:20	16:37:32
2005/076	17:23:23	17:24:08	17:24:56
2005/078	02:57:47	02:58:08	02:58:32
2005/078	03:44:17	03:44:56	03:45:38
2005/079	13:18:20	13:18:56	13:19:32
2005/079	14:05:05	14:05:44	14:06:20

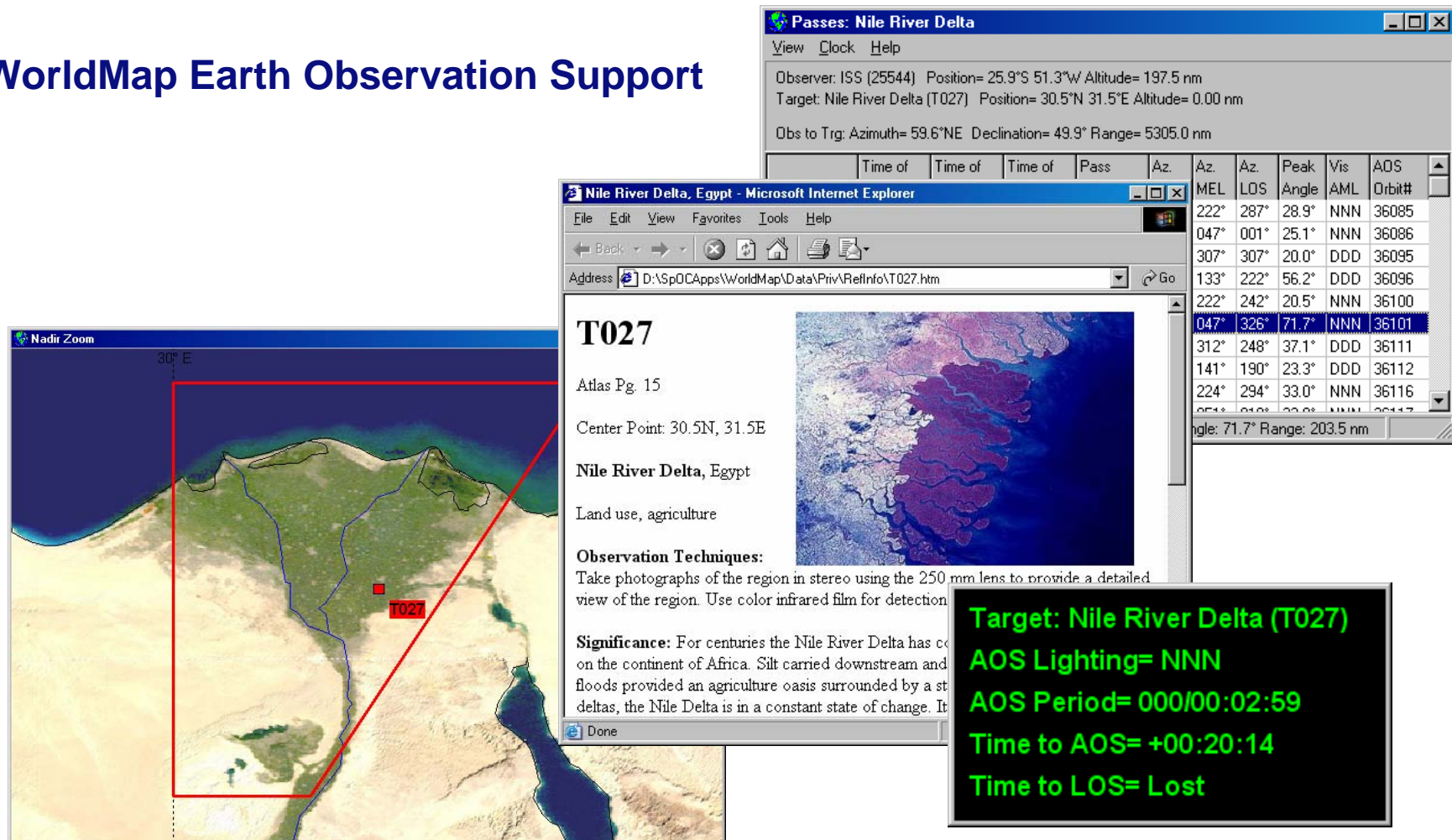
How are Laptops in Space Used?

WorldMap - Ground tracks & positions can be displayed for a virtually unlimited number of satellites simultaneously



How are Laptops in Space Used?

WorldMap Earth Observation Support



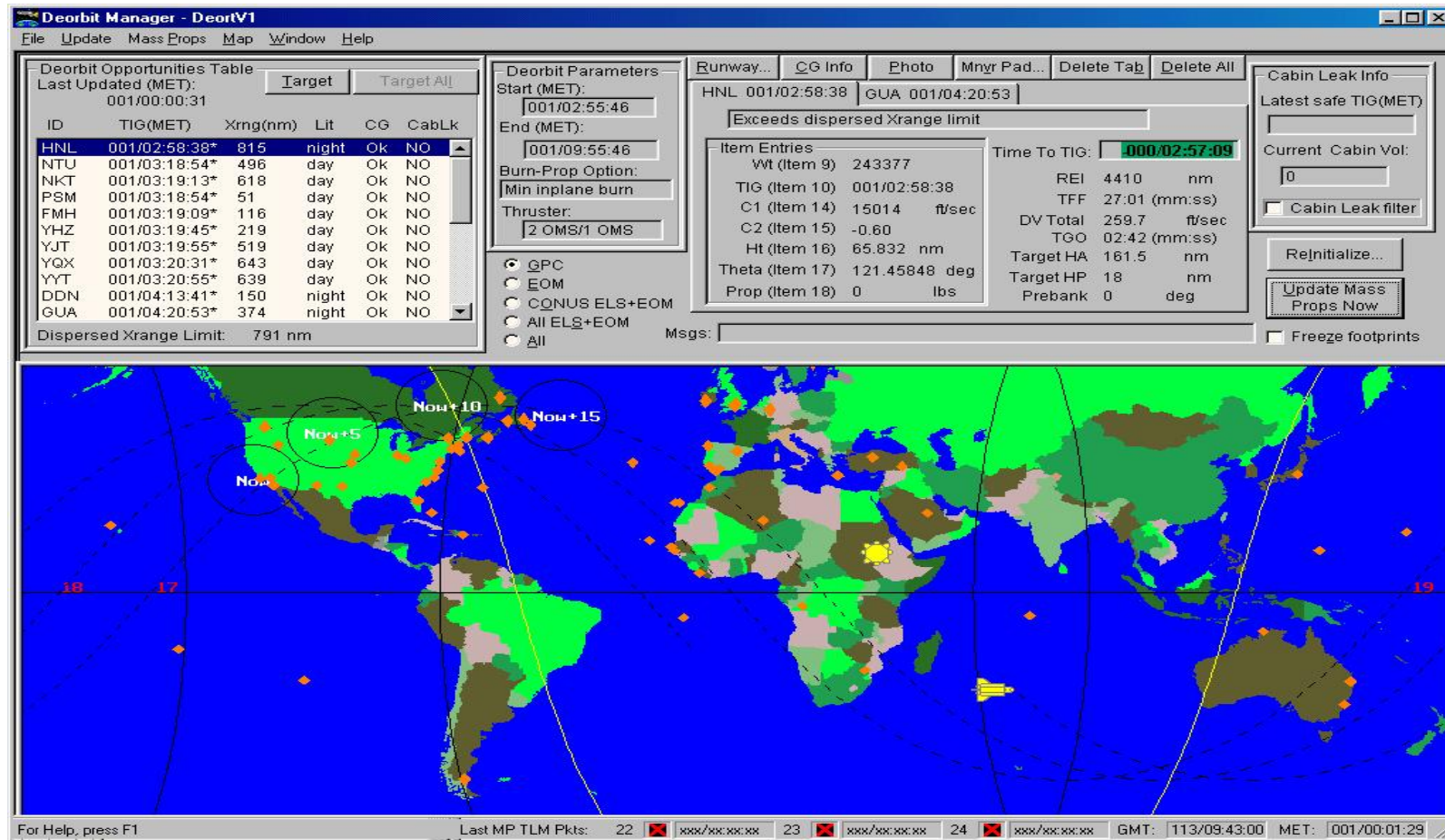
How are Laptops in Space Used?

WorldMap on a Personal Digital Assistant



How are Laptops in Space Used?

Deorbit Manager



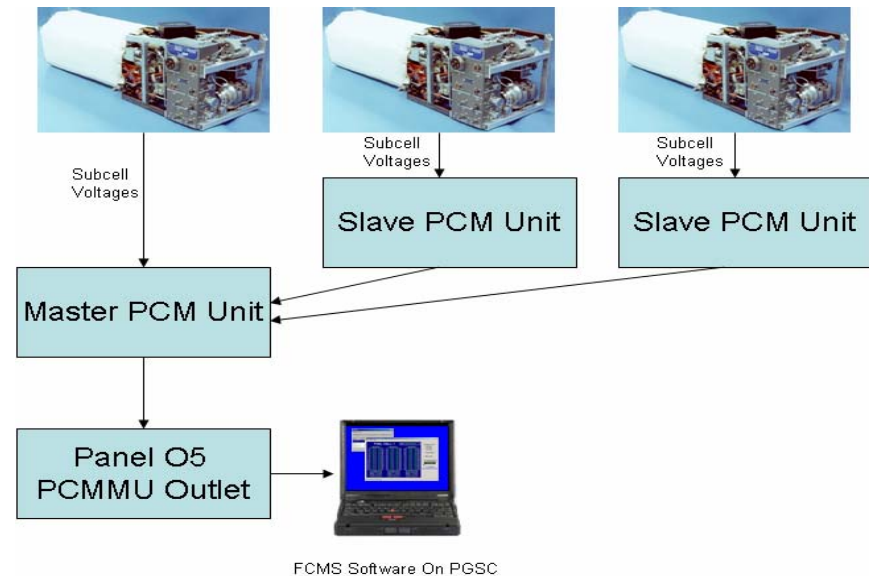
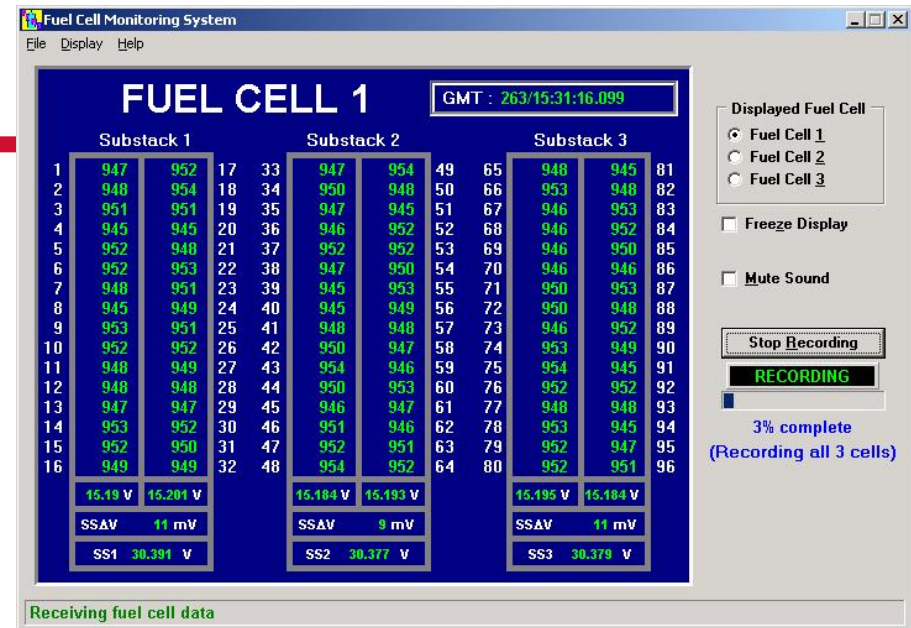
Fuel Cell Monitoring System

The Fuel Cell Monitoring System (FCMS) was developed in response to fuel cell issues that occurred on STS-83 causing early termination of the mission.

Each of the three fuel cells on the orbiter is comprised of 96 individual subcells (formed in three substacks per fuel cell). MCC uses a utility called the Fuel Cell Powerplant (FCP) Cell Performance Monitor (CPM) to monitor onboard fuel cell performance, however this utility can only display limited data on the three substacks of the fuel cell. Individual subcell voltages are unavailable to the MCC via the FCP CPM.

The FCMS provides direct access to the individual subcell voltages of each fuel cell giving ground controllers additional information on the status of each fuel cell. The subcell voltages of each fuel cell are distributed to a Pulse Code Modulation (PCM) unit, one per fuel cell. The signal from these three PCMs is then made available through the PCMMU port and accessed via the Payload and General Support Computers (PGSCs) where the voltages are recorded via the FCMS software.

The FCMS was first flown on STS-87. Using the application to record fuel cell voltage data has been added to the flight rules as a standard part of flight operations for every shuttle flight.

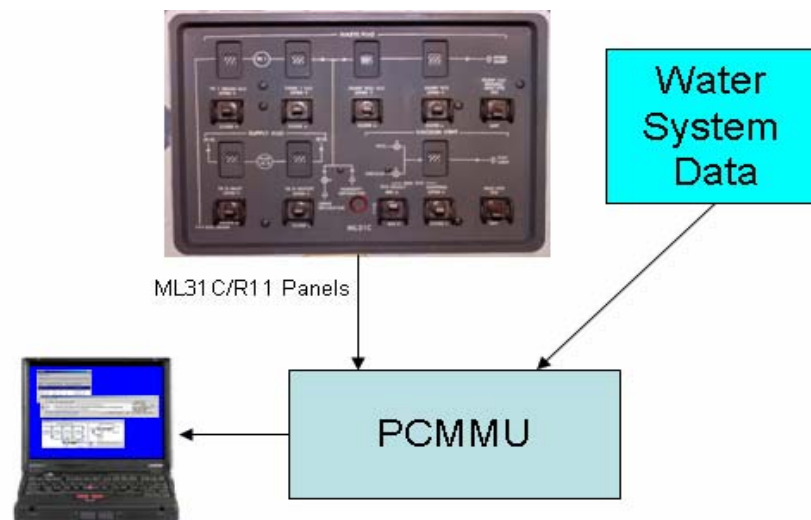
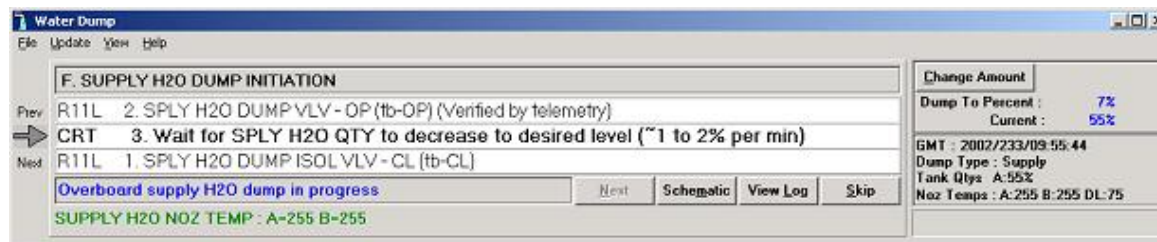


How are Laptops in Space Used?

Water Dump

WaterDump provides an electronic version of the Flight Data File (FDF) water dump procedure. By using real-time telemetry data, the application provides more capability to the crew than just a procedure viewer by automatically jumping to appropriate procedural steps at the appropriate time based on the telemetry data being received. A schematic display provides a graphical representation of the real-time status of the system.

This application was first flown on STS-85 and remains an option for the crew to use in addition to the paper water dump FDF procedure.

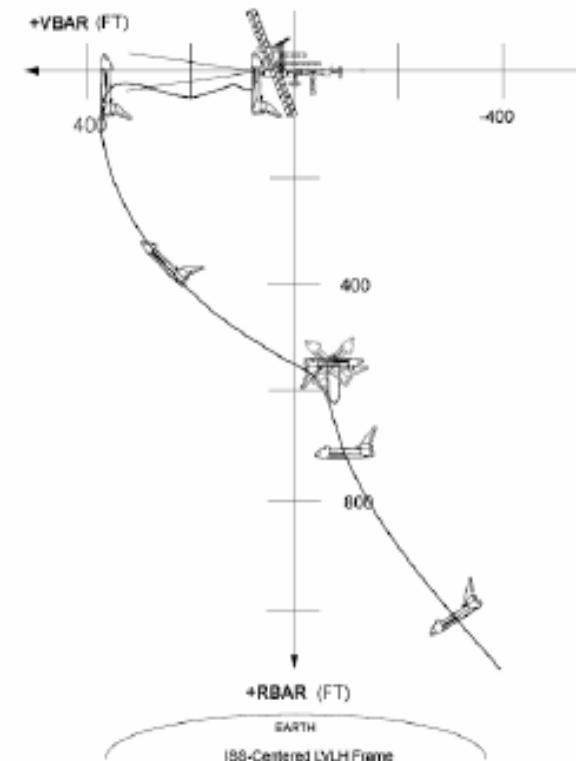


WaterDump Software On PGSC

How are Laptops in Space Used?

Rendezvous and Proximity Operations Application

- used by the Space Shuttle crews during rendezvous, proximity operations, undocking, and fly-around operations relative to ISS and other payloads/vehicles
- First used on STS-49 for multiple Intelsat retrieval attempts
- Flown on every rendezvous flight since



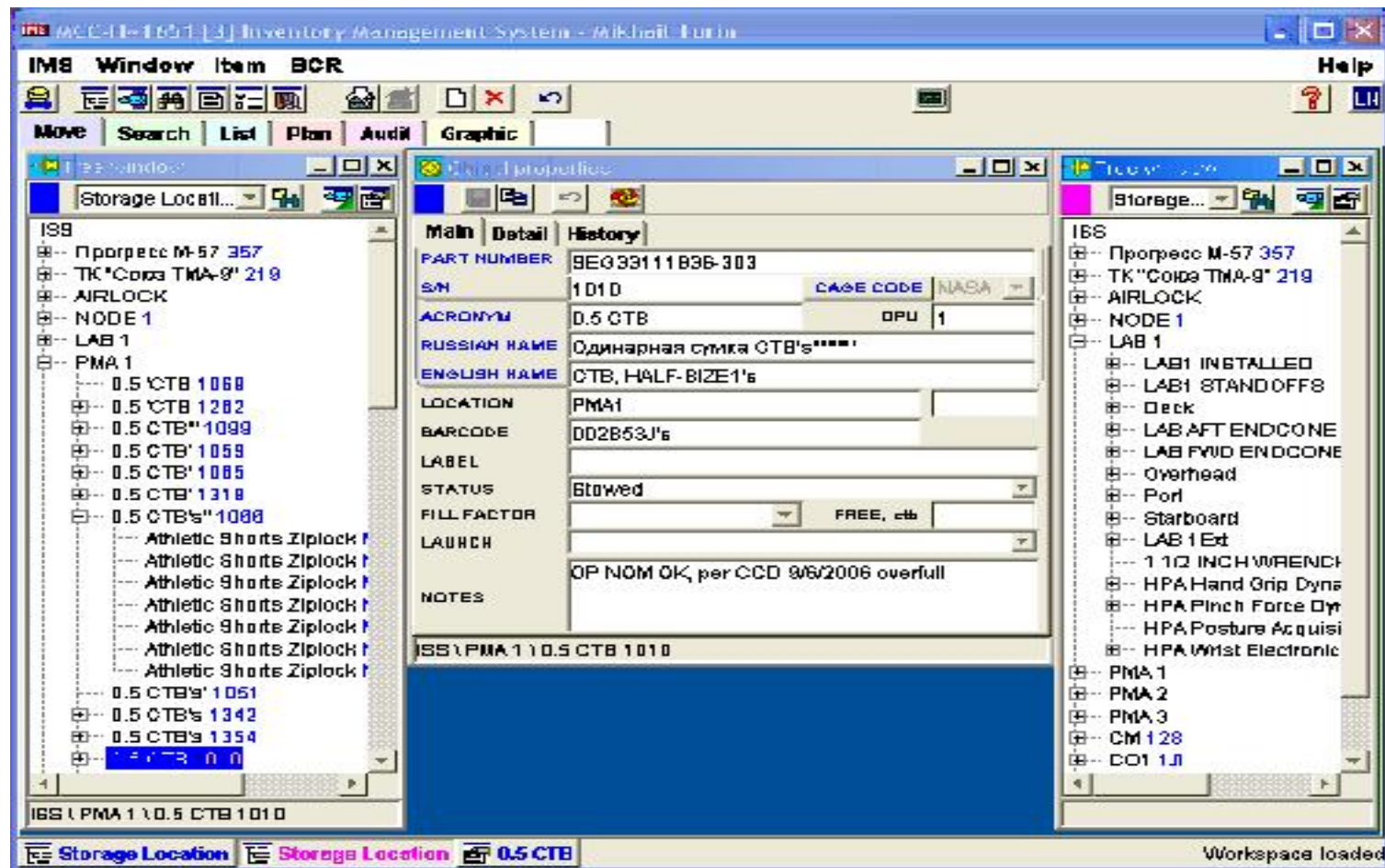
How are Laptops in Space Used?



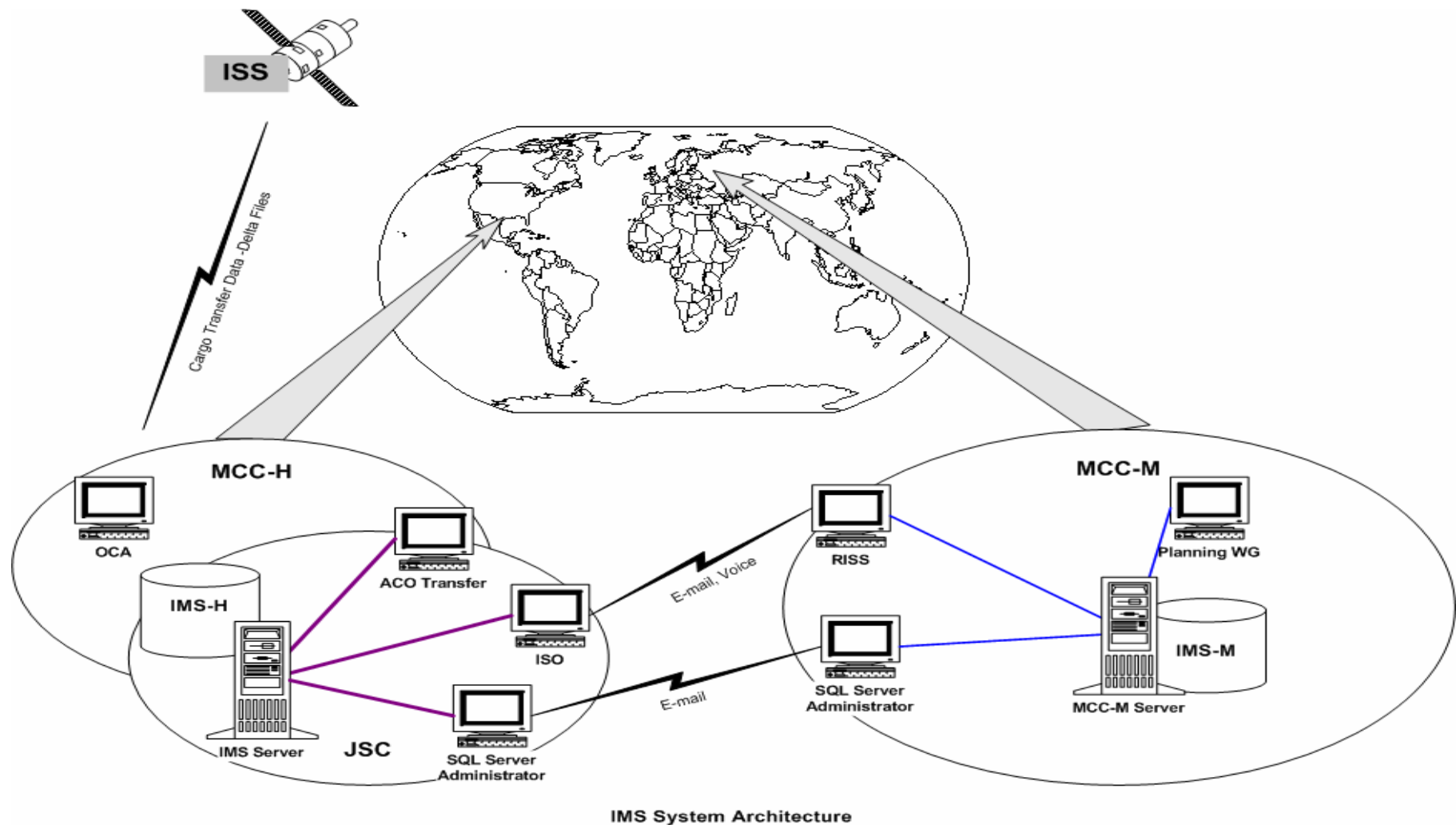
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How are Laptops in Space Used?

Inventory Management System

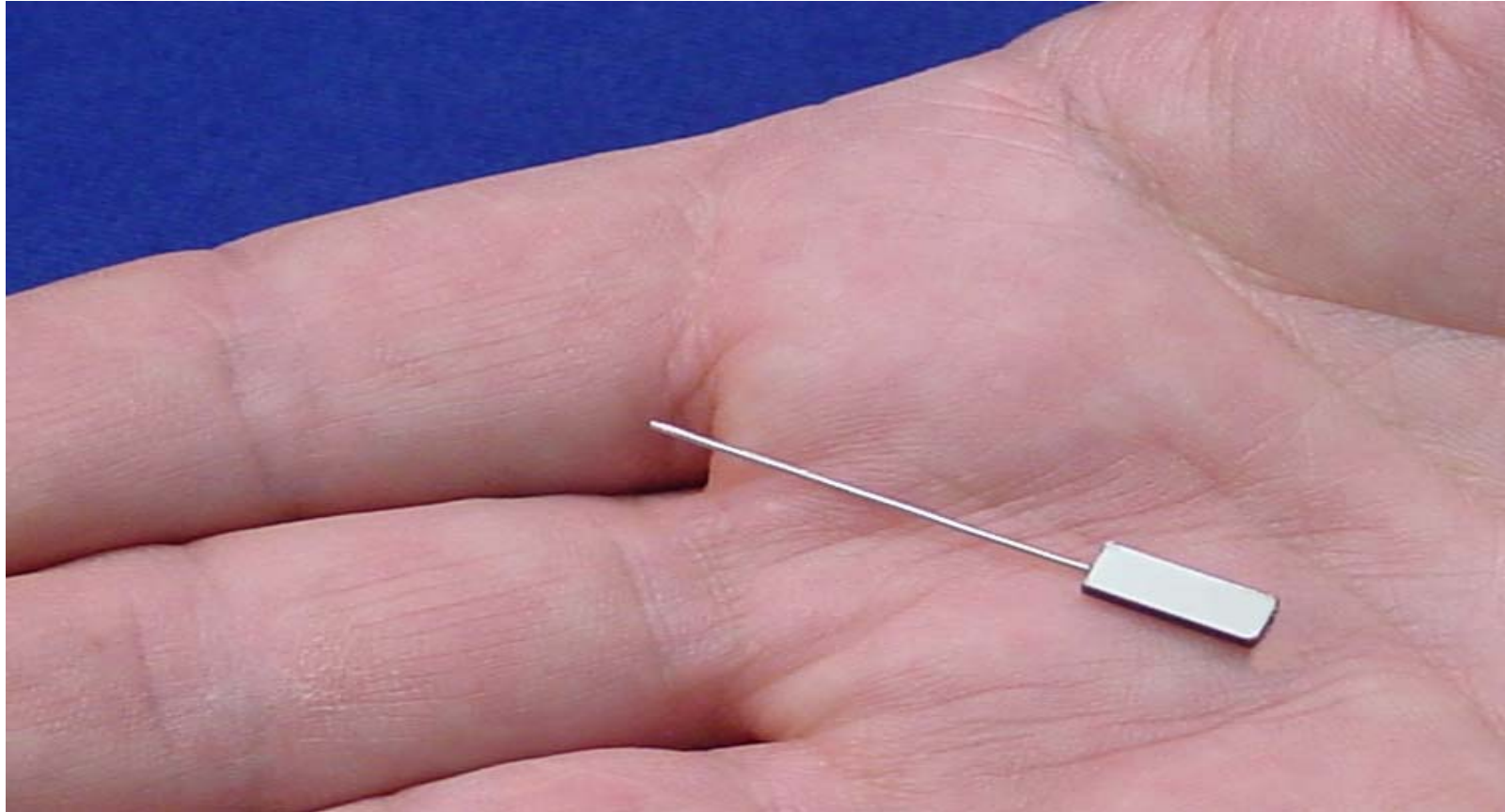


How are Laptops in Space Used?

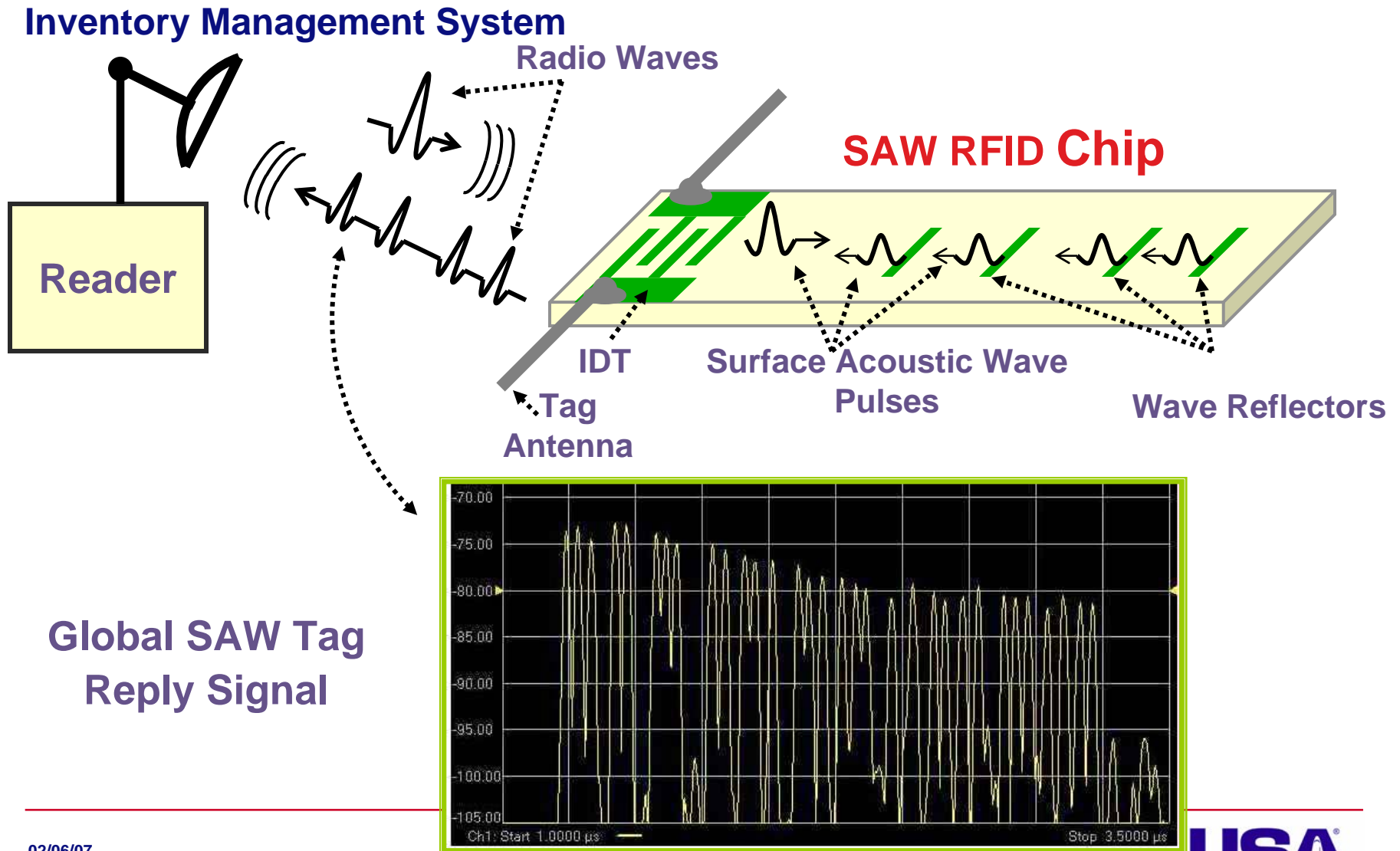


Radio Frequency Identification - RFID

RF SAW 64-Bit EPC Tag with Full Size Monopole Antenna

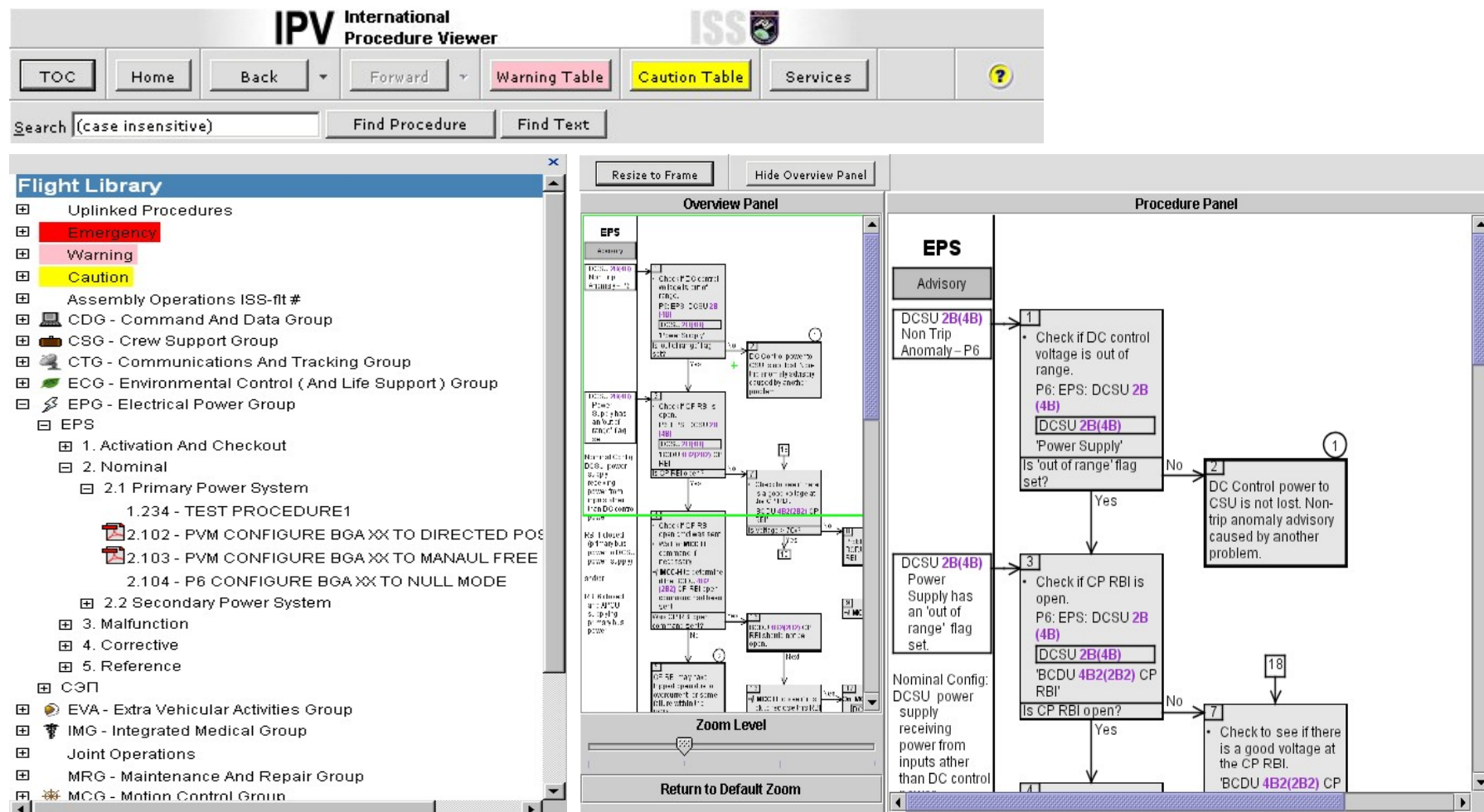


Radio Frequency Identification - RFID



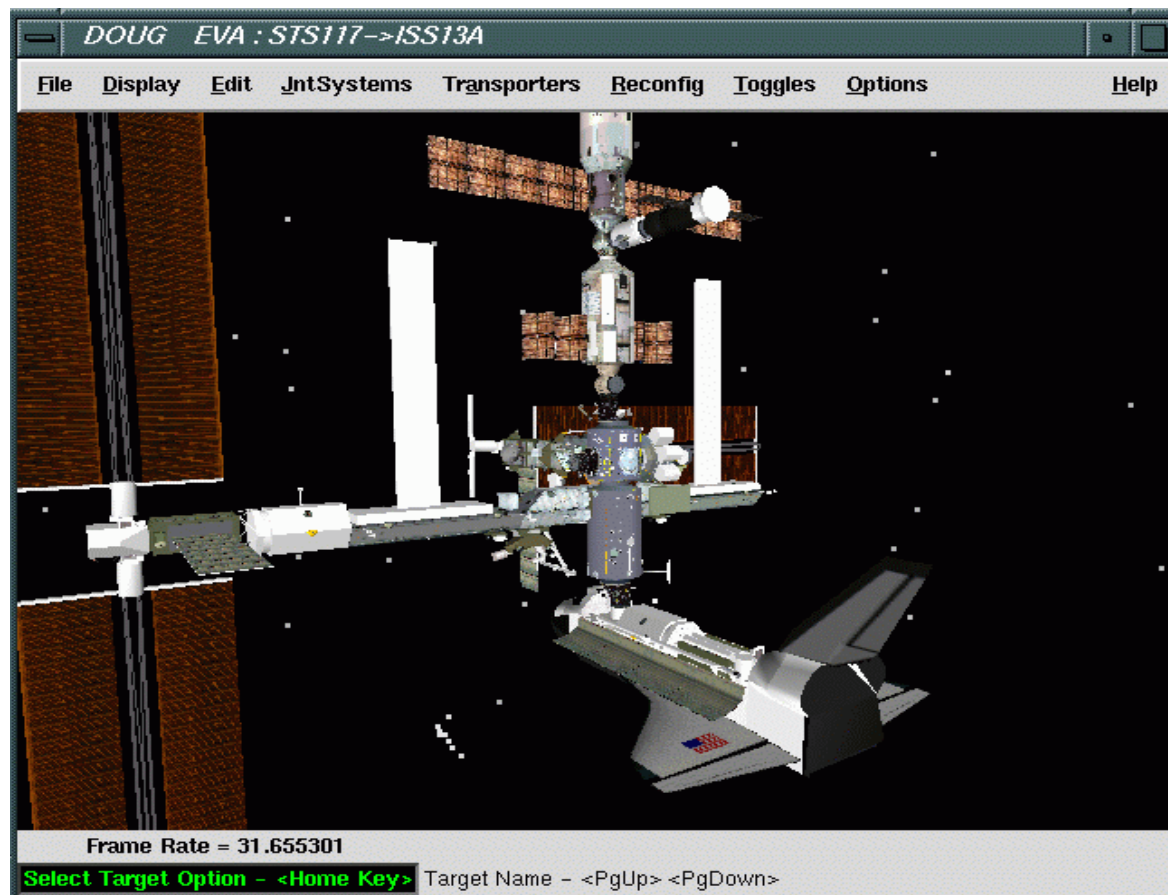
How are Laptops in Space Used?

International Procedures Viewer



How are Laptops in Space Used?

Dynamic Onboard Ubiquitous Graphics - DOUG



How are Laptops in Space Used?

- **DOUG Capabilities**
 - Provides a 3D graphical representation of ISS exterior
 - Used as a laptop based software training tool for procedure reviews, dry-runs, situational awareness during robotic operations.
 - Operator can use DOUG in standalone mode or connected to a PCS laptop for real-time updates of SSRMS joint angles.
 - Features included the ability to reconfigure models, proximity monitoring (“collision avoidance”) for SSRMS, and load predefined positions for cameras, SRMS & SSRMS joint angles
 - DOUG models are “best effort” and are not “certified” for dimension and position accuracy. Models are sufficient to use for training.

How are Laptops in Space Used?

DOUG Usage WRT Proximity Monitoring (“Collision Avoidance”)

Capabilities:

Calculates SSRMS boom distance to closest structure.

Provides visual and/or audible cues when boom approaches structure.

User can set the alarm distance.

- Default is 24”

Limitations:

Crit 3 software — model fidelity and validation are aimed at training and SA.

Only calculates distance between the two SSRMS booms and structure. Does not include joints, cameras or other ORUs attached to the boom.

Does not monitor collision between the boom and the wrist/shoulder/grappled payload structure (nuisance alarms).

DOUG proximity monitoring can also be affected by telemetry time delays, as much as six seconds

How are Laptops in Space Used?

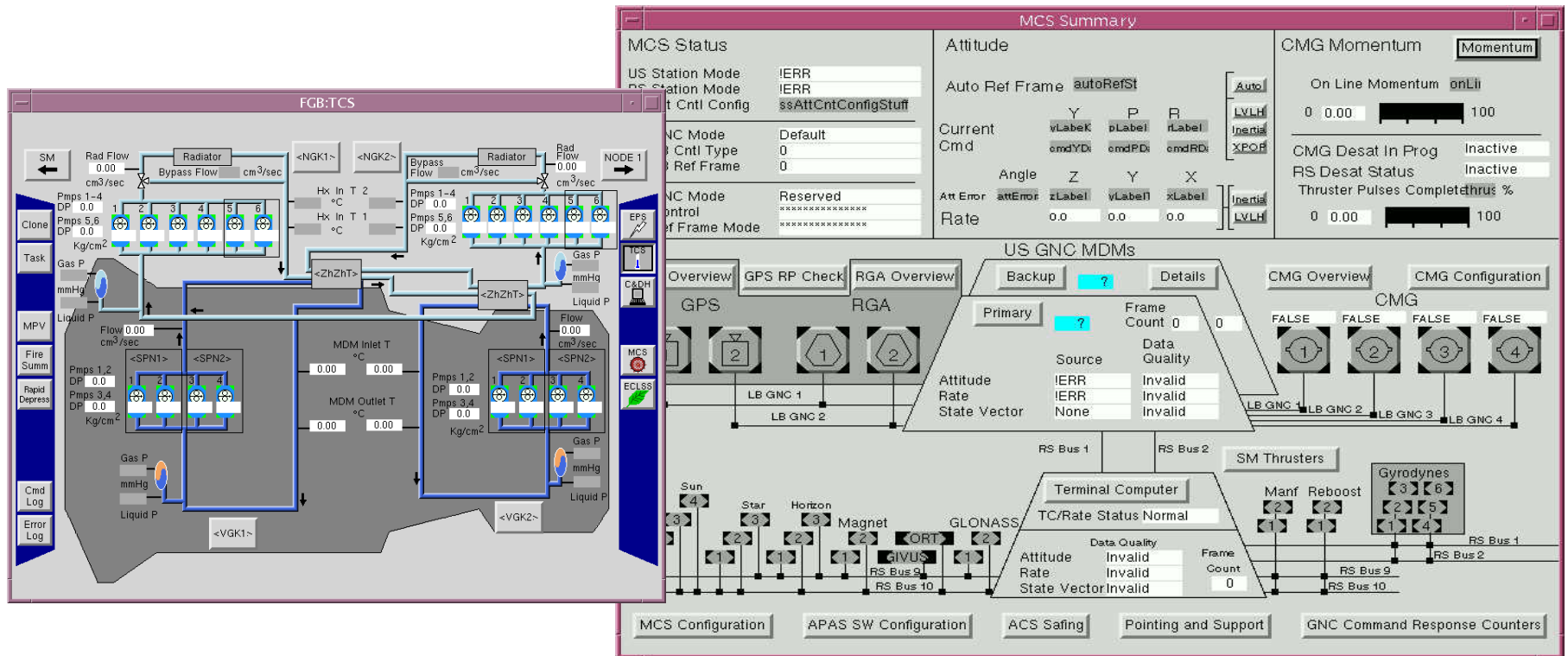
IP Phone



ISS002E7599 2001/05/16 21:51:15

How are Laptops in Space Used?

Portable Computer System



What are some of the management challenges?

- Hardware
- Software
- Criticality

What are some of the management challenges?

Hardware

Searching the onboard IMS Database for “laptop” returns:

Cage	ACRONYM	E OPS
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASS, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop	Laptop Computer Assy, IBM A31p
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASS, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASS, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop	Laptop Computer Assy, IBM A31p
NASA	A31p Laptop	Laptop Computer Assy, IBM A31p
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASS, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASS, IBM A31P
NASA	A31p Laptop	Laptop Computer Assy, IBM A31p
NASA	A31p Laptop	Laptop Computer Assy, IBM A31p
NASA	A31p Laptop	Laptop Computer Assy, IBM A31p
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P

What are some of the management challenges?

and..

Cage	ACRONYM	E OPS
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASS, IBM A31P
NASA	A31p Laptop	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop	Laptop Computer Assy, IBM A31p
NASA	A31p Laptop Kit	IBM A31P LAPTOP KIT
NASA	A31p Laptop Kit	IBM A31P LAPTOP KIT
NASA	A31p Laptop RSE1	LAPTOP COMPUTER ASSY, IBM A31P
NASA	A31p Laptop RSK1	LAPTOP COMPUTER ASSY, IBM A31P
NASA	ELC (EXPRESS LAPTOP COMPUTER) Installation	ELC (EXPRESS LAPTOP COMPUTER) Installation
NASA	ELC (EXPRESS LAPTOP COMPUTER) Installation	ELC (EXPRESS LAPTOP COMPUTER) Installation
NASA	ELC (EXPRESS LAPTOP COMPUTER) Installation	ELC (EXPRESS LAPTOP COMPUTER) Installation
NASA	LAPTOP CHASSIS	LAPTOP CHASSIS
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	Laptop Computer (IBM 760XD)	IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MODEL 760XD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	Laptop Computer (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	Laptop Computer (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	Laptop Computer (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD

What are some of the management challenges?

and...

Cage	ACRONYM	E OPS
NASA	Laptop Computer (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
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NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	LAPTOP
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	LAPTOP COMPUTER (IBM 760XD)	ASSEMBLY, IBM THINKPAD FLIGHT LAPTOP COMPUTER SYSTEM MOD
NASA	Medical Equipment Computer	Medical Equipment Computer
NASA	MEDICAL EQUIPMENT COMPUTER SYSTEM KIT	KIT ASSEMBLY, MEDICAL EQUIPMENT COMPUTER
NASA	MSG LAPTOP COMPUTER (MLC)	IBM THINKPAD LAPTOP W/ MSFC LABELS
NASA	MSG LAPTOP COMPUTER (MLC)	IBM THINKPAD LAPTOP W/ MSFC LABELS
NASA	PGSC, 760XD COMPUTER	IBM THINKPAD ASSEMBLY
NASA	PGSC, 760XD COMPUTER	IBM THINKPAD ASSEMBLY
NASA	PGSC, 760XD COMPUTER	IBM THINKPAD ASSEMBLY

What are some of the management challenges?

and still more...

Cage	ACRONYM	E OPS
NASA	PGSC, 760XD COMPUTER	IBM THINKPAD ASSEMBLY
NASA	PGSC, 760XD COMPUTER	IBM THINKPAD ASSEMBLY
NASA	Ziplock Bag	ZIP LOCK BAG
RSA00	A31p Laptop	Laptop Computer Assy, IBM A31p
RSA00	A31p Laptop	Laptop Computer Assy, IBM A31p
RSA00	A31p Laptop	Laptop Computer Assy, IBM A31p
RSA00	A31p Laptop RSE-Med	Laptop Computer Assy, IBM A31p
RSA00	A31p Laptop RSE-Med	Laptop Computer Assy, IBM A31p
RSA00	Laptop 1	Laptop Thinkpad
RSA00	Laptop ПАКЕТ	Laptop Thinkpad
RSA00	Laptop1	Laptop Thinkpad
RSA00	Laptop1	Laptop Thinkpad
RSA00	Laptop2	Laptop Thinkpad
RSA00	Laptop2	Laptop Thinkpad
RSA00	Laptop2	Laptop Thinkpad
RSA00	Laptop2	Laptop Thinkpad
RSA00	Laptop3	Laptop Thinkpad
RSA00	Wiener Power Note	Компьютер Wiener Power Note
RSA00	Аудит ноутбуков PC	NULL
RSA00	Б/И Форматы Laptop	NULL
RSA00	Б/И Форматы Laptop	NULL
RSA00	Лэптоп ThinkPad A22P	NULL
RSA00	Лэптоп ThinkPad A22P	NULL
RSA00	Переходник к LAPTOP	Переходник к LAPTOP
RSA00	Переходник к LAPTOP	NULL
RSA00	Переходник к LAPTOP	NULL
RSA00	Переходник к LAPTOP	NULL
RSA00	Переходник к LAPTOP	NULL
RSA00	Переходник к LAPTOP	NULL

What are some of the management challenges?

Software - from the ISS SSC IBM 760XD client load manifest

SSC Client Operating System: Windows '98 SE (4.10.2222A)			
Windows Applications			
ActiveMovie Control	Win98	Inbox Repair Tool	Win98
Address Book	Win98	My Briefcase	Win98
Backup	Win98	Notepad	Win98
Calculator	Win98	Paint	Win98
CD Player	Win98	Quick View	Win98
Character Map	Win98	Sound Recorder	Win98
Clipboard Viewer	Win98	Synchronize	Win98
Dial-Up Networking	Win98	Volume Control	Win98
Disk Defragmenter	Win98	Winpopup	Win98
Explorer	Win98	WordPad	Win98
HyperTerminal	Win98	Windows Media Player	7.0
Imaging	Win98	Winsock	2.0

What are some of the management challenges?

and...

COTS Applications		
Application	Version	MCC Console Position
Acrobat Reader	4.0	OpsPLAN/ODF
Asymetrix DVP	4.0	CAPCOM
Context Translator	3.5.18	CAPCOM
Cyrillic Keyboard	5.0	CAPCOM
DirectX	7.0a	OSSCO
Ghost Explorer	5.1c	OSSCO
Internet Explorer	5.50.4134.0600	OSSCO
-Additional Web Fonts	N/A	OSSCO
-AOL ART Image Format Support	N/A	OSSCO
-Browsing Enhancements	N/A	OSSCO
-Chat	2.5	OSSCO
-Core Fonts	N/A	OSSCO
-DirectAnimation	N/A	OSSCO
-Dynamic HTML Data Handling	N/A	OSSCO
-Japanese Text Display Support	N/A	OSSCO
-Language Auto Selection	N/A	OSSCO

What are some of the management challenges?

and...

COTS Applications		
Application	Version	MCC Console Position
Inetrenet Explorer Administration Kit (IEAK)	5	OSSCO
Microsoft Office	2000 (SR-2)	OSSCO
-Microsoft Access for Windows	2000 (SR-2)	OSSCO
-Microsoft Excel for Windows	2000 (SR-2)	OSSCO
-Microsoft Outlook for Windows	2000 (SR-2)	OSSCO
-Microsoft PowerPoint for Windows	2000 (SR-2)	OSSCO
-Microsoft Word for Windows	2000 (SR-2)	OSSCO
K995	1.0	OSSCO
Microsoft ActiveSync	3.0	OSSCO
Norton AntiVirus Corporate Edition **	7.50.846	OSSCO
PCAnywhere	9.2.1	OSSCO
PC Card Director	3.10	OSSCO
PC Card Late Update	1.0	OSSCO
QuickTime Movie Player	4.0	CAPCOM
QuickTime Picture Player	4.0	CAPCOM
Real Player	4.0.20.158	CAPCOM
Screen Cam	2.1	OSSCO

What are some of the management challenges?

and...

Operational Software			
Application	Version	Validation Level	MCC Console Position
AutoIWIS	5.0	Class III	CIO
Earth Obs Atlas Program	1.0	Class III	Earth Obs (TSC)
EarthKAM	6.0	Class III	POD
EMU Battery Discharge	Rev. A	Class II	EVA
Ester ①	N/A	Class III	POD
FPP (Floating Potential Probe)	2.2	Class III	PHALCON
ISS HAM	1.0	COTS	IMC
IWIS	4.2.2	Class III	CIO
KU Band File Transfer	2.0.1.1	Class I	OpsPLAN/ OCA
Netmeeting video utility	1.0	Class III	OSSCO
OOCI			
-MPV	2.0	Class I	OpsPLAN/ ODF
-OSTPV	2.0	Class II	OpsPLAN
Ops Hab Survey	3.0	Class IV	BME
Proshare	1.9 A	COTS	BME
TeSS_Eval		Class III	BME
WinPack	6.70	COTS	IMC

What are some of the management challenges?

and...

Robotics Software			
Application	Version	Validation level	MCC Console Position
BEV			
-Bird Seed	2.0	Class I	OSSCO
-ISP Server	2.2	Class I	OSSCO
-MCS BEV	2.3	Class I	ADCO
-PCS DAS (Dictionary files)	12A.011		OSSCO
D.O.U.G. (DP122002)	1.4	Class II	CIO
RSAD	1.2	Class I	ROBO

What are some of the management challenges?

and...

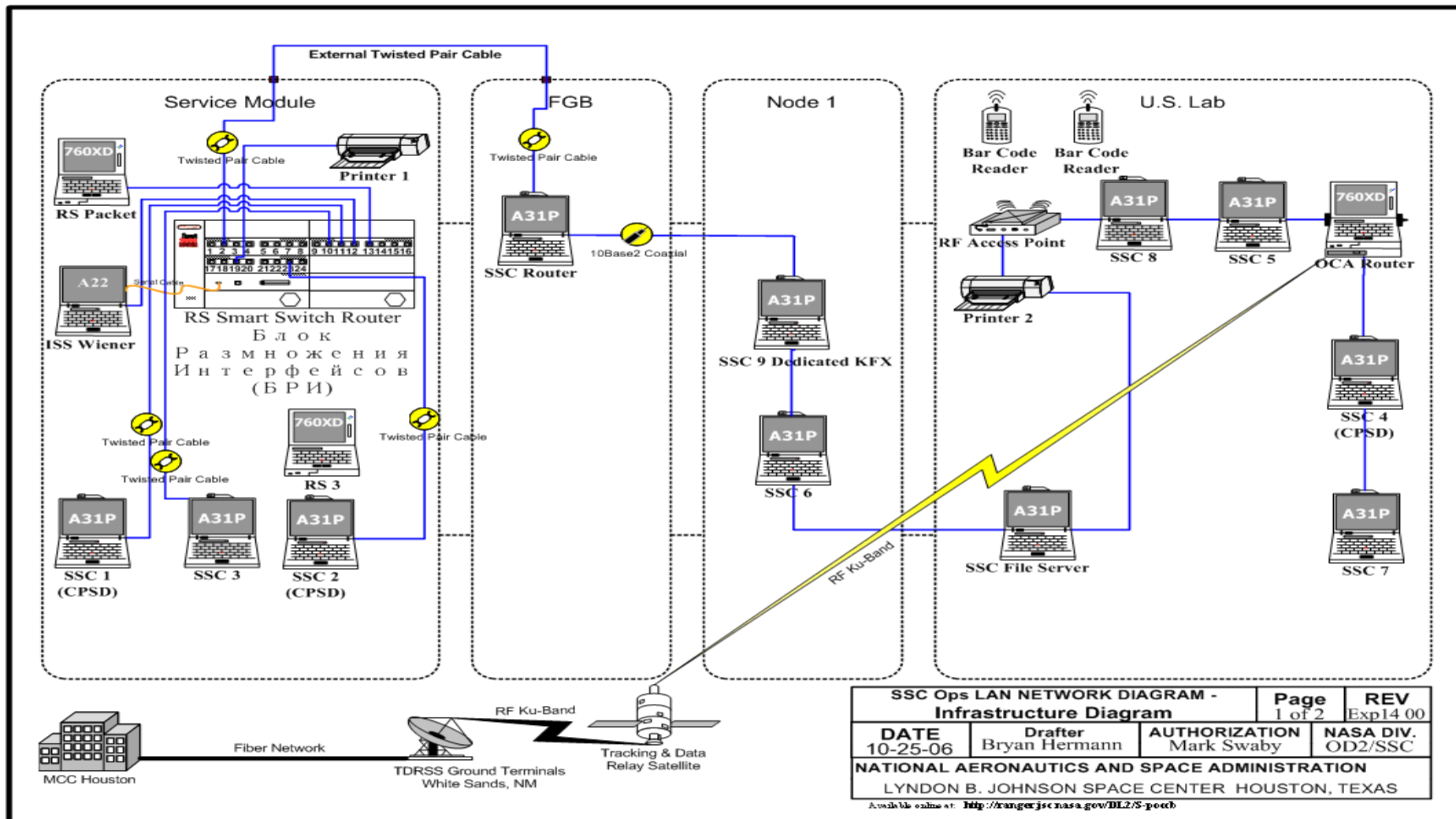
SpOC Applications			
Application	Version	Validation level	MCC Console Position
Capture Master	1.0	Class III	OSSCO
File Sniffer	1.02	Class III	OSSCO
FTP Server	0.69	COTS	OSSCO
HazMat	4.05	Class III	POD
Ini Change Editor (ICE)	2.0	Class III	OSSCO
Inventory Management System			
-IMS	1.39	Class II	CIO/ ISO
-Barcode Reader	1.01	Class II	CIO/ ISO
Packet Display programs (PDP)	1.03	Class III	OSSCO
PingMaster 2000	2.05	Class I	OSSCO
Pistol Grip Tool (PGT)	3.02	Class II	EVA (TITAN)
POC PLOT	1.0c	ClassIII	OSSCO
Quaternion Euler Converter	1.01	Class I	CAPCOM
Time Utilities	3.0	ClassIII	CAPCOM
World Map	4.03	Class II	CAPCOM
-Pass Wizard	3.01	Class II	CAPCOM
-Telemetry Server	2.1	Class II	OSSCO

What are some of the management challenges?

and...

COSS Applications			
Application	Version	Validation Level	MCC Console Position
ASAP Player	N/A	Class III	CAPCOM
Greetings	1.3.0.0	Class III	BME
ISS Library Reference Tool	2.5.1.7	Class III	CAPCOM
ISS Wallpaper Changer	1.0.4.1	Class III	BME
QRZ!	Vol. 19	COTS	IMC
Sky Watch	1.2.0.1	Class III	CAPCOM
COSS Timer	1.0.0.0	Class III	CAPCOM
Unit Conversion	4.10	Class III	CAPCOM
Video Capture	1.2.0	Class III	OSO/PTV
Video Overlay	1.2.3	Class III	OSO/PTV
Voting In Space	1.0	Class III	CAPCOM
VR Bubble Viewer	2.0	Class III	CAPCOM
Whip! Viewer	4.0	Class III	CAPCOM

What are some of the management challenges?



What are some of the management challenges?

“Art is limitation; the essence of every picture is the frame.”

G.K. Chesterton

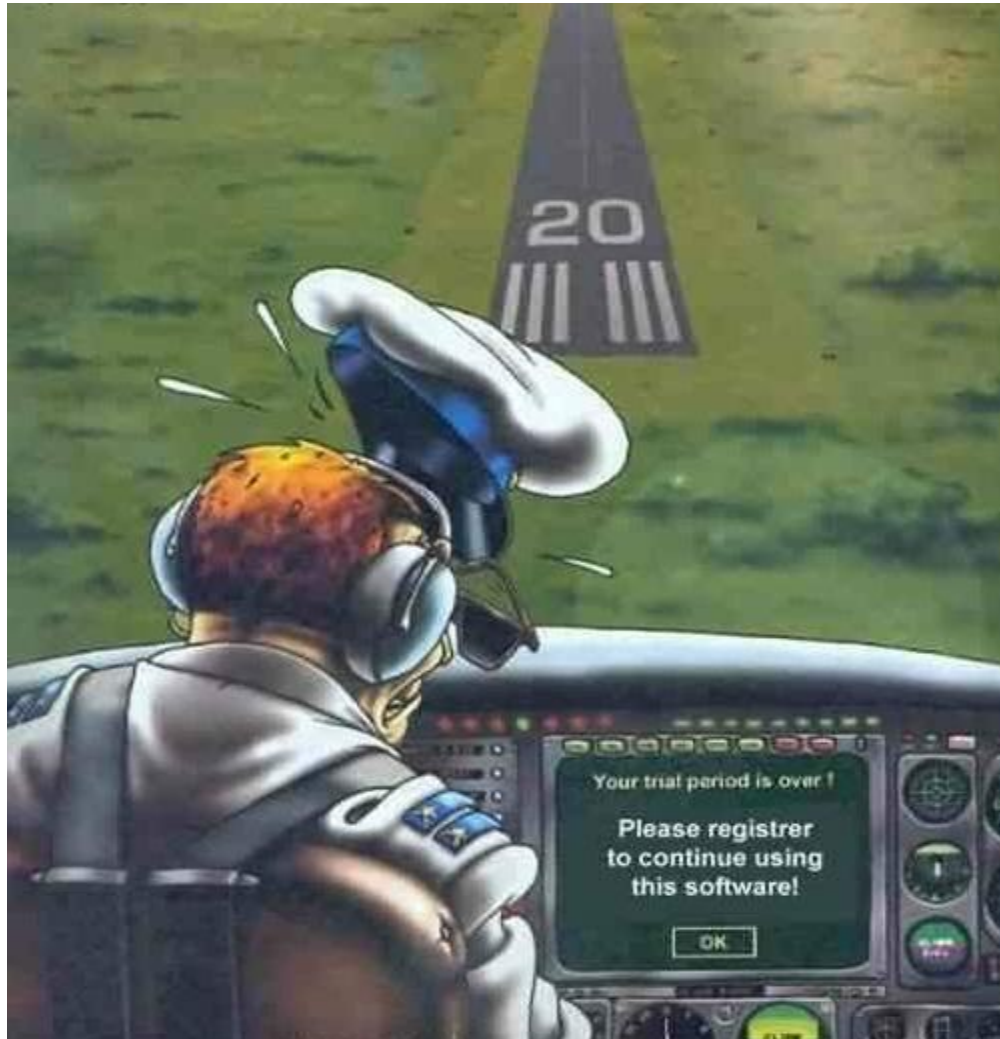
What are some of the management challenges?

- From NSTS 222206 - REQUIREMENTS FOR PREPARATION AND APPROVAL OF FAILURE MODES AND EFFECTS ANALYSIS (FMEA) AND CRITICAL ITEMS LIST (CIL)

TABLE 4.1
GSE CRITICALITY CATEGORY DEFINITIONS

Criticality	Potential Effect or Failure
1	Single failure which could result in loss of life or vehicle.
1R	Two redundant hardware items, which if both failed, could result in loss of life or vehicle (or loss of a safety or hazard monitoring system listed in Table 4.5).
1S	Single failure in a safety or hazard monitoring system that could cause the system to fail to detect, combat, or operate when needed during the existence of a hazardous condition and could result in loss of life or vehicle.
2	Single failure which could result in loss (damage) of a vehicle system.
3	All others.

What are some of the management challenges?



What are some of the management challenges?

- Criticality 1 - PCS, RTF
- Criticality 2 - Payloads
- Criticality 3 - PGSC, SSC “All others.”

Looking Forward

- **Return on Investment**
 - “Laptops in Space may be the most cost effective technology ever utilized by NASA for human spaceflight”
- **Looking forward**
 - Upgrade to the onboard ISS network infrastructure starting on Expedition 15
 - RFID SDTO targeted for Expedition 16-17
 - Upgrade to the IBM A31P ThinkPad targeted for FY08
 - Potential improvements for telemetry distribution, OCA hardware software, and software deployment processes
 - ISS docking video system
- Shuttle has been a laptop technology test bed for Station; Station should be the same for Constellation

The End (not)



Laptops in Space:

Not only does everybody want one...

Everybody needs one!

